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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/679,023	10/04/2000	Xiao-Bo Wang	471842000200	5573

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EXAMINER

BROWN, JENNINE M

ART UNIT	PAPER NUMBER
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1755

DATE MAILED: 01/14/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/679,023

Applicant(s)

WANG ET AL.

Examiner

Jennine M. Brown

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 09 December 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 25-41, 44-48 and 65-78 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 25-41, 44-48 and 65-78 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. §§ 119 and 120

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.  
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_ 6) ☐ Other: \_\_\_\_\_

***Finality***

Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn.

***Claim Rejections - 35 USC § 112***

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 25 and 44 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claims contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventors, at the time the application was filed, had possession of the claimed invention. The limitation "non-movably" referring to the piezoelectric transducer and electrode elements are not supported by the specification as originally filed.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 25 and 44 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

It is unclear whether the electrodes claimed are on one substrate or are on more than one substrate. It is also unclear whether these electrodes are parallel or perpendicular or in another configuration. It is unclear as to whether the electrodes controlling electrophoretic or dielectrophoretic forces are the same electrodes as those which are controlling the piezoelectric forces. It is unclear whether one single generator is used to make both the electrophoretic or

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dielectrophoretic forces as well as the piezoelectric forces. It is unclear whether more than one generator is used to make the electrophoretic or dielectrophoretic forces as well as the piezoelectric forces. Furthermore, it is unclear as to the frequency cutoff when the AC transducer is creating a dielectrophoretic force (Hz) or whether it is creating an acoustic force (Hz).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 25-41, 44-48, 65-78 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yasuda, et al. (US 6216538) in view of Becker, et al. (US 6294063) and Becker, et al. (US 5888370).

Yasuda, et al. teach an electrophoretic and acoustic force apparatus for field flow fractionation with carrier medium (col. 3, l. 19-35; col. 7, l. 15-20; col. 9, l. 58-63; col. 12, l. 63). At least two electrode and at least two piezoelectric transducers are taught (acoustic - col.

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5, l. 62 – col. 6, l. 2; col. 6, l. 43-49; col. 7, l. 26-29, 44-48; col. 11, l. 11-17; col. 15, l. 45-49; electric – col. 10, l. 33-34, 38-45; col. 11, l. 18-24; col. 12, l. 1-3; col. 15, l. 43-44). Phase of the wave can be varied as well as the amplitude, which can create an inhomogeneous acoustic field (col. 6, l. 30-42). Yasuda, et al. teach that the acoustic wave generating elements can be switched back and forth to be either wave sending or wave receiving and each element can be individually controlled (col. 7, l. 57 – col. 8, l. 5; col. 8, l. 33-36). Example 1 teaches a method of sequential and or simultaneous use of both electrophoretic and acoustic fields. Yasuda, et al. do not specifically teach inlet and outlet ports or an array of electrodes. The example given in column 20, line 52 - column 21, line 4 illustrates a tube with electrodes and piezoelectric transducers for acoustic manipulation of a particle, having an inlet and outlet at each end. It would have been obvious to one of ordinary skill in the art that a tube has an inlet and outlet because a tube has openings on opposing sides of the cylindrical form.

The apparatus for a piezoelectric transducer array and an electrophoretic electrode array are the same. Both arrays are formed out of alternating electrodes on a substrate. Because the electrode formations are the same, the array of piezoelectric transducers could also be used for electrophoretic manipulation when the controller uses a direct current rather than an alternating current. It would have been obvious to one of ordinary skill in the art to change the type of current passed through the controller to modify the type of separation.

Becker, et al. teach multiple inlet and outlet ports in an electrophoretic field flow fractionation apparatus as well as an array of electrodes (col. 4, l. 46 – col. 5, l. 3) for manipulation of sample (Figures 9, 9B, 11, 12, 13). Becker, et al. teach a chamber with at least one inlet port and at least one outlet port (col. 3, l. 26-28) with at least two electrode elements and preferably an electrode array disposed along a portion of the chamber energized by an

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electrical signal generator to create an electrical field to cause an electrophoretic force normal to the traveling direction of a carrier medium (col. 3, l. 49 – col. 4, l. 10, 35-40) whereby the chamber may be a tube (col. 28, l. 1-2). The AC or DC signal generator can be connected to a plurality of electrical conductor buses connected to more than two individual electrode elements (col. 7, l. 16-36; col. 20, l. 34-56). Alternately, electrode elements can be adapted longitudinally or latitudinally along the inside or outside of the chamber whereby the array may be parallel, interdigitated, castellated, polynomial or plane (col. 4, l. 1-40, 47-50). Electrode elements are made of metal layer(s) on the surface of the chamber, particularly gold and chromium (col. 7, l. 16-21; col. 20, l. 56-62). These elements create a spatially inhomogeneous electric field (col. 5, l. 9-20) to vary the magnitude and frequency of the electrical signals (col. 4, l. 64 – col. 5, l. 8). Becker teaches introducing a medium into the apparatus (Example I, col. 16, l. 16 – col. 17, l. 51) and into the chamber giving a velocity profile and applying at least one electrical signal to provide an electrophoretic force on the medium normal to the traveling direction of the carrier medium and a second electrical signal used to generate an acoustic wave to displace matter normal to the direction of the carrier medium. Since the programmable manipulation force can be a dielectrophoretic force, electrophoretic force, an optical force or a mechanical force (ultrasonic force – col. 7, l. 63 – col. 8, l. 5) therefore it also inherently has the ability to move a packet by electrophoretic or ultrasonic movement depending on whether the force generator is DC or AC and the frequency of the AC as modulated by the controller for the force generator.

Applicants succinctly pointed out the following:

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- multiple inlet and outlet ports in an electrophoretic field flow fractionation apparatus as well as an array of electrodes (col. 4, 1. 46 - col. 5, 1. 3) for manipulation of sample (Figures 9, 9B, 11, 12, 13) - the '063 patent;
- a chamber with at least one inlet port and at least one outlet port (col. 3, 1. 26-28) with at least two electrode elements and preferably an electrode array disposed along a portion of the chamber energized by an electrical signal generator to create an electrical field to cause an electrophoretic force normal to the traveling direction of a carrier medium, (col. 3, 1. 49 - col. 4, 1. 10, 35-40) whereby the chamber may be a tube (col. 28, 1. 1-2) - the '370 patent;
- the AC or DC signal generator can be connected to a plurality of electrical conductor buses connected to more than two individual electrode elements (col. 7, 1. 16-36; col. 20, 1. 34-56) - the '370 patent;
- alternately, electrode elements can be adapted longitudinally or latitudinally along the inside or outside of the chamber whereby the array may be parallel, interdigitated, castellated, polynomial or plane (col. 4, 1. 1-40, 47-50) - the '370 patent;
- electrode elements are made of metal layers) on the surface of the chamber, particularly gold and chromium (col. 7, 1. 16-21; col. 20, 1. 56-62) - the '370 patent;
- these elements create a spatially inhomogeneous electric field (col. 5, 1. 9-20) to vary the magnitude and frequency of the electrical signals (col. 4, 1. 64 - col. 5, 1. 8) - the '370 patent;

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- Becker teaches introducing a medium into the apparatus (Example 1, col. 16, 1. 16 - col. 17, 1. 51) and into the chamber giving a velocity profile and applying at least one electrical signal to provide an electrophoretic force on the medium normal to the traveling direction of the carrier medium and a second electrical signal used to generate an acoustic wave to displace matter normal to the direction of the carrier medium - the '370 patent;
- and since the programmable manipulation force can be a dielectrophoretic force, electrophoretic force, an optical force or a mechanical force (ultrasonic force - col. 7, 1. 63 - col. 8, 1. 5) therefore it also inherently has the ability to move a packet by electrophoretic or ultrasonic movement depending on whether the force generator is DC or AC and the frequency of the AC as modulated by the controller for the force generator - the '063 patent.

It would have been obvious to one of ordinary skill in the art to combine the references of Becker, et al. because they are both dielectrophoretic apparatus having an array of electrodes on one or more substrates which are connected to a controller to exert dielectrophoretic forces on substance. It would have been obvious to one of ordinary skill in the art to provide inlet and outlet ports so that the flow can go into one part of the device and out another part of the device. It would have been obvious to one of ordinary skill in the art to combine the teachings of Becker, et al. as described previously with that of Yasuda, et al. because the array of electrodes can generate both electrical and acoustic fields which may be generated and/or controlled simultaneously. Both Yasuda, et al. and Becker, et al. teach electrophoretic forces used to separate samples and both teach the use of controllers to control the electrodes to create the forces used and it would have been obvious to one of ordinary skill



in the art to program a controller to use one or more of the forces to realize a better separation of components in a system because both electrical fields and acoustic fields are known to focus separations in a capillary or slab (flat surface) where sample position, separation, spatial relation and detection can be done easily and can be automated by a computer.

### ***Double Patenting***

Claim 44 is objected to under 37 CFR 1.75 as being a substantial duplicate of claim 25. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Both claim an apparatus with a chamber having at least one inlet and outlet port, at least two electrode elements non-movably adapted along a portion of said chamber, electric signal provided by an electric signal generator and at least one piezoelectric transducer non-movably adapted along a portion of said chamber, piezoelectric signal provided by an electric signal generator.

A recitation of the intended use of the claimed invention must result in a structural difference between the claimed inventions in order to patentably distinguish the claimed invention. See *In re Casey*, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 136 USPQ 458, 459 (CCPA 1963).

### ***Response to Arguments***

Applicant's arguments with respect to claims 25-41, 44-48, 65-78 have been considered but are not persuasive.

A. 112 Rejection

There is no support in the specification for the use of "non-movably" regarding the adaptation of the piezoelectric and electrode elements. Applicants have failed to support this limitation in the specification.

Examiner made other rejections for further clarification on how the device simultaneously creates (di)electrophoretic forces and acoustic forces.

B. 103 Rejection

Yasuda reference

The argumentation where Yasuda do not teach the combination of electrophoretic and acoustic force used in combination is invalid because applicants admit in their previous argumentation on page 11, line 24, that both electrophoretic and acoustic forces are taught in combination in the same reference. In response to Applicant's argument that the electrophoretic and acoustic forces taught in Yasuda are different than that presently claimed, it has been held that the mere fact that the references relied on by the USPTO fail to evince an appreciation of the problem identified and solved by applicant is not, standing alone, conclusive evidence of the nonobviousness of the claimed subject matter. The references may suggest doing what an applicant has done even though workers in the art were ignorant of the existence of the problem. In re Gershon, 152, USPQ 602 (CCPA 1967).

Becker, et al. references

The US 6294063 reference and the US 5888370 are commonly owned and assigned. Both Becker, et al. references teach dielectrophoretic movement of a packet as described above. Both teach electrical manipulation forces can be used to separate material and both teach a force generator for the modulation of the electrodes by the controller.

Yasuda reference in view of the Becker references

Regarding the definition of tube and for evidentiary purposes, the examiner has included the following definition of "tube" as given by the Online Merriam-Webster Dictionary. (<http://www.m-w.com/cgi-bin/dictionary>)

"Main Entry: **tube**    **1** : any of various usually cylindrical structures or devices: as **a** : a hollow elongated cylinder; *especially* : one to convey fluids **b** : a soft tubular container whose contents (as toothpaste) can be removed by squeezing **c** (1) : **TUNNEL** (2) *British* : **SUBWAY**  
**b d** : the basically cylindrical section between the mouthpiece and bell that is the fundamental part of a wind instrument"

The Becker, et al. references cure the defects of Yasuda, et al. by providing multiple inlet and outlet ports as well as electrode arrays. Both are used to manipulate packets of particles using an array for movement, fusion and detection, both have computer control of the systems and both have individual control of each transducer and electrode for manipulation of individual packets and would be considered analogous art. As described above, the Becker et al. references state that both electrophoretic and mechanical forces may be generated by the apparatus as illustrated in Figure 1 (col. 7, l. 63 – col. 8, l. 5). The passage cited by Applicants was one embodiment disclosed by Becker, et al. which uses the second electrode in a sensing capacity. This second embodiment does not constitute non-analogous art and does not destroy the primary reference. The apparatus is based on the use of electrodes and those electrodes can be used for application of electrophoretic forces, acoustic forces or can be used in conjunction with a feedback control loop to sense position of a packet in the chamber. All of these forms of electrode manipulation are performed using a force generator which is controlled by a computer and the fields used on the electrodes can be AC or DC and can be homogeneous

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or inhomogeneous. A low frequency electrical field generated will be an electrophoretic force while a high frequency electrical field generated will cause an acoustic force to be generated.

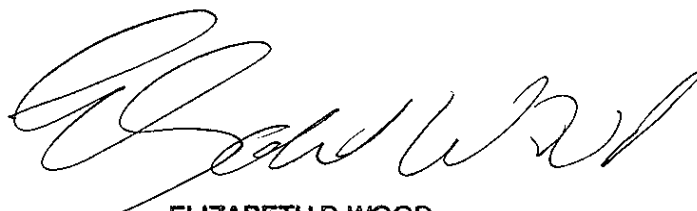
As for the inlets and outlets which Becker, et al. teach, it still does not destroy or teach away from that of Yasuda, et al. because Yasuda teaches electrophoretic forces used in a tube where acoustic forces are also used and a tube inherently has inlets and outlets therefore this does not modify the apparatus of Yasuda or teach away from it.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennine M. Brown whose telephone number is (571) 272-1364. The examiner can normally be reached on M-F 8:00 AM - 6:00 PM; first Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Bell can be reached on (571) 272-1362. The fax phone number for the examiner where this application or proceeding is assigned is (571) 273-1364.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (571) 272-1200.

jmb



**ELIZABETH D. WOOD**  
**PRIMARY EXAMINER**